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Using the Global GPS Network and Other Satellite Data to Monitor ionospheric Total Electron Content

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A globally distributed network of dual-frequency global positioning system (GPS) receivers is the primary source of data used to measure. ionospheric total electron content (TEC) on global scales. Maps of TEC useful for calibrating propagation delays, or monitoring the solar-terrestrial environment, can be produced using this cent inuousl y operat ing network. The maps can also form the basis of a TEC calibration service for users around the world. Potential users may include single-frequency satellite altimetry missions , satellite tracking stations and astronomical observatories. The GPS network currently contains over 50 stations, covering a latitude range from 77S to 78N degrees, each tracking, between 4 and 8 GPS satellites simultaneous y.

In addition to this GPS resource, the TEC data set can be augmented using other dual-frequency tracking systems, such as the DORIS system developed by the French space agency CNES. DORIS tracking relies on doppler shift measurements between ground beacons and a satellite receiver over count intervals of about 7 seconds. Only relative changes of slant TEC near the satellite can be derived from the doppler counts. The DORIS network of 50 beacons sequentially transmit a signal to a small number of compatible satellites, notably the TOPEX/POSEIDON ocean altimetry mission.

Techniques for processing the global TEC data set to produce an empirica l global TEC map will be discussed. A general method of incorporating both absolute (GPS) and differential (DORIS) TEC da ta wi ll be described. Comparisons between the globs l '1'1 ;C maps and an independent source **of** TEC data, **derived from the.** TOPEX dual-frequency **ocean altimeter, will be presented.** Such comparisons are useful for evaluating the accuracy of the global maps (with and without DORIS data) over the oceans where distances between GPS receivers exceed several thousand kilometers. Calibration accuracies of better than 5 TECU arc possible in the northern mid-latitudes under typical ionospheric conditions and moderate solar activity. To improve the accuracies in the southern hemisphere and equatorial regions, we have moved from a thin shell approximation to a layered three-dimensional model by incorporating information from seasonal or parametrized models such as Bent and P] M (the parametrized ionosphere model).

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